SCIENCE AND INDUSTRY

ORGANIC GARDENING

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J. I. Rodale, Editor | Sir Albert Howard, C.I.E., M.A., Associate Editor

With the Editor

"The Living Soil," a book by Lady Eve Balfour

LADY Eve Balfour, whose article entitled "My experiences and opinions on Indore Composting" appears in this issue of Organic Gardening, has just written a remarkable book called "The Living Soil." The publishers are Faber and Faber of London, England. It is a brilliant piece of work and shows evidence of much deep research. She also shows that she is quite a farmer.

Up to the time of writing I have been able to read only 50 pages, much of which deals with the medical and health aspects of organic farming, so I would therefore like to discuss this angle of the subject. Lady Balfour shows that the published statistics seem to indicate that the general health of the public is improving, but that actually there is more ill health in certain brackets. Not as many deaths are occurring in childbirth, the infective diseases are under much better control but the degenerative diseases are on the increase. These include blood pressure diseases, heart disease, rheumatism, diabetes, kidney disease, cancer, mental disease, etc.

In 1938 Lord Laymington wrote, "workers insured under the National Health Insurance Act lost on an average twenty-eight days of work a year through illness, compared with about 16 days of work fifteen years ago."

Medical care in all its forms in the United States costs about $3,500,000,000 a year. This is three and a half billions, not millions. Can you imagine how the general health of the public would be improved if the Government would spend half this amount to make compost out of materials now going to waste and give it to farmers in the form of a subsidy?

"Although it is true that our life span has been increased, yet an analysis of that gain shows it is confined almost entirely to lower age groups. Excluding infant mortality and the diseases of childhood, and excepting also our control of the major pestilences the chances of dying after you reach thirty-five are about as great today as they were a hundred years ago. . . . Until recently we did not know that disease could be absolutely proved to be intimately connected with diet."

Sir Robert McCarrison, a physician who lived among the Hunzas of India found them

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to be singularly free of disease and the healthiest race he had ever encountered. Upon further study he found this was due to their fine diet representing food produced by natural methods. He decided to find out if he could produce the same results in experiments with white rats.

One group he fed the diet of the Hunzas which was composed of "freshly ground whole wheat flour made into cakes of unleavened bread, milk and the products of milk (butter, curds, buttermilk) pulses (peas, beans, lentils), fresh green leaf vegetables, root vegetables (potatoes, carrots), and fruit, with meat occasionally." The other group was fed on a diet "consisting of white bread and margarine, tinned meat, vegetables boiled with soda, cheap tinned jam, tea, sugar and a little milk: a diet which does not contain enough milk, milk products, green leaf vegetables and whole meal bread for proper nutrition.

"This is what happened. The rats fed on the good diet grew well, there was little disease amongst them and they lived happily together. Those fed on the bad diet did not grow well, many became ill and they lived unhappily together; so much so that by the sixtieth day of the experiment the stronger ones amongst them began to kill and eat the weaker, so that I had to separate them. The diseases from which they suffered were of three chief kinds: diseases of the lungs, diseases of the stomach and intestines, and diseases of the nerves; diseases from which one in every three sick persons, among the insured classes, in England and Wales, suffer."

Lecturing at the College of Surgeons in 1931 McCarrison described how he had maintained a little world of rats free of disease for over two and a quarter years. One would imagine that so revolutionary an experiment would have created a profound impression among these medical men. It did not do so.

"The inescapable conclusion is that in a very large number of diseases faulty food is the primary cause. The suspicion is that faulty food is the primary cause of such an overwhelming mass of disease that it may prove to be simply *the primary cause of disease.*"

Lady Balfour discusses the causes of pneumonia. On the one side the medical textbooks give as causes, weakness of old age, debilitating habits, exhaustion, chill, previous attack, some other illness, a blow on the chest, and the pneumococcus microbe. Nothing is usually said about the effect of the food we eat. What is the barrier through which the pneumococcus microbe attacks? "This barrier is the fine skin which lines the tubes and cells of the nose, wind-pipe and bronchial tubes, of the mouth, throat, stomach and small and large gut. The fine interior skin is much the same as the outer skin of the body, only it is thinner and softer. But both have an outer layer of cells called epithelium, and it is the epithelium that can be particularly well seen under the microscope. It is the epithelium that forms the visible barrier and which shuts out microbes and other intruders. It does not by any means form the whole barrier, but it constitutes a part of it, which can be seen as clear and definite or blurred and indefinite, according to whether it is itself well or ill fed."

In other words in examining the white rats under the microscope McCarrison unmistakably noticed a startling contrast in the structure of the membranes of the nose, head, etc. where rats were poorly fed the membranes were thinner and weaker. Where rats received a good diet the membranes were thicker and stronger. Here then is the answer! The pneumonia germ can penetrate the barrier more easily when that barrier becomes weakened and if the right kind of food will help us build a stronger barrier, then let us make a determined effort to get the right kind of food."

I want to digress for a moment and talk about an experience in our own family which corroborates this discovery. A few years ago I decided to try and do something about my tendency to catch cold very easily. After reading up on the subject I eliminated all forms of grain from my diet. This meant avoiding bread, whether white or whole wheat, cakes, pies, corn, all forms of breakfast foods, cereals, spaghetti, etc.

After, about three or four weeks my head became much clearer, and a mild catarrhal condition cleared up. The number of colds greatly decreased, and when I did catch one it was very mild and cleared up in a day or two. When my wife saw the results after about a year she suggested that the whole family (including 3 children) go on that diet. The results were very good. It cleared up a stubborn case of constipation for Mrs. Rodale. But it is the peculiar twist that it took in the case of my son Robert who was about ten at that time that I want to mention.

The family was on this grainless diet for about a year. My wife found it rather difficult to continue on account of having to pack school lunches, and sandwiches were so convenient. Soon they were back on the old diet. Now my son had for many years been afflicted with poison ivy infection and he would get it in a most severe form. He would get it without even going near the weed. During the year that he was on a grainless diet he was absolutely free of it. When he returned to his old eating habits back came the poison ivy and he has had it every year since.

The eating habits of children are extremely important to their health and well-being, but alas, most parents are somewhat slack due to personal inconveniences. When a child comes from school and is hungry, what is the easiest thing for the mother to do? She gives sonny a slice of bread generously smeared with jam. When he sits down to supper, he likes to eat bread and butter and may eat two, three and even four slices before mother is aware of what is going on. The result is that he doesn't feel like eating the green peas, lettuce, carrots and other vegetables on the table.

When Bobby was on a grainless diet he had to gobble up all the vegetables, otherwise he would have gone hungry. I have read somewhere that the average person is going around with a mild case of scurvy of the skin. The physicians call it a sub-clinical case of scurvy. It is so mild that you would have to use the microscope to notice it, but it is there just the same. The skin is thinner and weaker, just like McCarrison's ill-fed rats. The doctors go on to say that it is due to a lack of vitamin C, and vegetables abound in this vitamin.

Evidently my son, in the years that he was bothered with poison ivy, had this sub-clinical form of scurvy. His skin was thin and burned on the merest contact with the ivy chemical. In the year when he ate no bread, and had to eat much vegetable matter (rich in vitamin C) his skin must have strengthened to such an extent, that the ivy could not penetrate the skin barrier.

I do not believe that it is necessary to cut out eating all of the grain foods, but medical experience would seem to indicate that its consumption should be drastically reduced, and that whole wheat should be substituted for white bread. One or two slices of bread a day per person should be sufficient.

Now, if a gain in health can be effected by eating the proper kinds of food, imagine the spectacular improvement that would come about if we ate food raised from a *soil* that was in optimum health. The next few years will yield up convincing evidence, as a result of experiments now going on.

J. I. Rodale

Earth-worm Tillage

By Christopher M. Gallup

Condensed from NEW ENGLAND HOMESTEADER

EARTHWORM tillage helped us to cut down our last year fertilizer bill 14%, reduce the corresponding feed bill by 7%, keep our sales on an even keel, and increase our December 31st inventory of live stock, feed and supplies by 89%. And at that we are just getting started. Biologists who have studied them closely tell us that in really good soil the worm holes or burrows should be about two inches apart. They further assure us that with such spacing, and plenty of dead vegetation to eat, earthworms would then throw out on top of the ground the best possible plant food at the rate of one ton per acre per week for the growing season.

Foresters have known about this soil-building by earthworms for many years, but we tillers of the soil have been a bit slow at learning how to use them. We have gone blindly on hiding their food with our mould-board plows, instead of

leaving it on top of the ground, where for countless eons they (the night-crawlers) have always hunted for it. Anyone can see for himself what this does to the land, by comparing the soil along an old wall where the plow couldn't get in, with that in the middle of the field where the earthworms have been driven out.

Earthworms stranded on a dry sidewalk after a summer shower are such a common sight that any statement of their continuous need for moisture would be superfluous. Of course they have it on the surface when the dew is falling, and also when it rains. At other times they go down their vertical holes or burrows until they feel comfortable. We have encountered them while digging drainage ditches during a dry season as much as four feet below the surface.

Dead vegetation has to be "tenderized" by alternating sunshine and rain or by time before an earthworm can eat it. Judging by what unfavorable weather can do to our hay, it is easy to believe that the vegetable part of the earthworm's ration is little more than crude fibre or cellulose. Naturally that has to be supplemented or balanced. So far as we are aware, this phase of the earthworm's requirements has not been subjected to scientific inquiry, but we do know that he "tanks up" with fine particles of earth down below the usual tillage level. Under the influence of his digestive apparatus, and the benign bacteria to which he is presumably host, the insoluble mineral compounds from the lower levels are converted into soluble and highly nitrogenous plant food. This he finally leaves on the surface of the ground, often to the dismay of golf players attempting delicate shots on the putting greens.

Our discovery of earthworm tillage arose from a determination to seed some winter rye on a gravel knoll, where the top soil had washed away, and the oversized gravel was packed in like paving stones. The heavy sulky tractor plow that we then owned just bumped along over them. As a pure experiment, we borrowed a heavy duty spring tooth harrow from a neighbor, and went over the knoll with that. The flexible teeth found the interstices between the cobbles, and presto, we had a passable seed bed for the rye.

The result of this experiment was so gratifying that we staged a "brag-fest" with the County Agent about it. He in turn suggested using the harrow just after the frost had come out, to loosen and roll out the cobbles nearest the surface. This worked so well that we tried it on the better fields *instead of plowing*. The normal tillage season was lengthened about three weeks by this change, and was found to have other advantages. The added time gave us the chance to spread and harrow in our barn manure day by day. The early contact with the soil gave the bacteria that much more time to ripen the raw manure, and convert it into plant food before the crops actually needed it. There was also opportunity to harrow down two or three weed sproutings before it was time to plant.

Now the first-thaw harrowing pulled all the old grass and weed roots up and on the surface, where the alternating rain and sunshine of early spring made them surprisingly brittle. We didn't then know that we were making the finest earthworm food possible, but the earthworms moved right out from along the walls, and multiplied like the Israelites of old, only more so. After one or two seasons of harrow tillage, the earthworm burrows became so numerous that we spotted them along with the soil improvement. From then on it was comparatively simple to plan our cropping, so there would always be something for our little soil builders to eat. In time we hope to furnish them all they can eat.

Since we traded our sulky tractor plow for a new heavy duty spring tooth harrow six years ago, our crop yields have been on the up and up. Starting with an ear corn yield well below the bumper level of 100 bushels per acre, we had the satisfaction in 1941 of husking 147 bushels from one carefully measured acre. More recently we applied the rag doll test to thirty ears selected for our 1942 seed plot, and got vigorous germination 100%, for the first time. By the light of our experience to date, we firmly believe that earthworm tillage will bring back the soil fertility of colonial times, of which the big houses still standing on many of our hinterland farms offer highly credible evidence.

Miami's Compost Project

By C. G. Berning

From THE HERALD (Miami, Florida)

SCREENED by a shady forest of densely planted Florida oaks and pines, an important Miami postwar project is progressing at the city nursery.

On this 10-acre tract, acquired only a few years ago, Park Superintendent J. Gerry Curtis is accumulating trees, shrubs, pines, ferns and ornamentals that will be sorely needed in the city-wide postwar beautification program. He already has a total of 28,439.

A constant plugger on this job is "Hogger,"—a unique contraction that is churning coconut husks and fronds into valuable compost at the rate of more than 20 cubic yards a day.

The machine is an adaptation of the motor driven knives used in North Carolina to macerate lumber.

"In agriculture the most essential thing is compost," Curtis explains. "Especially here where we have so much sand to deal with, we need good compost to bind it and hold the water and fertilizer."

Curtis' ingenuity is providing for the city a compost at an estimated cost of $2.10 a cubic yard that otherwise would cost $4 or $5 a cubic yard.

Not only that, but the operation utilizes the coconut husks and fronds which are cleaned from the streets and coconut products factories and makes the compost available within three months whereas following nature's routine course would require two years, Curtis points out.

Husks are fed into the hopper which leads them to the revolving knives. These in turn macerate the husks and throw the particles into the bed of a large truck. The truck then is driven to a dairy where the product is used as bedding for the cattle.

After two or three weeks the impregnated bedding is returned to the nursery and introduced to orderly piles of macerated coconut husks and fronds, thus spreading the compost-making b a c t e r i a. Each pile of 1,500 cubic yards each, is separated from the o t h e r s by truck driveways, making them easily accessible. They are kept wet and, when labor is available, are turned over and over.

This work, going on now slowly and quietly, will be appreciated when, after the war, the soldiers have left and Miami will be thinking again of lawns and flower beds.

Curtis said that this compost then will be available in huge quantities to make a foundation for new lawns in Bayfront park and other city park areas.

A thought in this connection is that the coconut husk bedding could be supplied at $7 a ton to racehorse stables which are bedded ordinarily with straw at $32 a ton. And straw may not be available this year in the amounts needed because of war transportation problems.

An idea passed on to the county commission by "Hogger" would effect an untold saving in building Crandon park on Biscayne key.

The problem here is disposal of large quantities of coconuts and coconut tree fronds, and hauling in of a compost needed as a binder for the almost sterile sand. A Hogger, jr., mounted on a tractor could chew up the debris and churn it into the sand right on the spot, solving both problems with a few turns of the Diesel motor.

Hints For the Victory Gardener

This is the eleventh of a series of articles by this author dealing with the cultivation of ordinary vegetables

By Roger W. Smith

ASPARAGUS

IN the early Spring your Victory garden offers you few pleasures greater than the cutting of the luscious early spears of an established planting of asparagus. It was because of its habit of producing early shoots that the ancient Persians named the plant "asparag" meaning sprout.

Until modern times asparagus was a medicinal plant. When you consider the great dietary value the early and abundant supply of green spears must have had to those early men who must have struggled through the long winter upon a poorly balanced diet, this is easily understood. But like many other medicinal plants asparagus later became a garden favorite. Its popularity is still increasing.

It is possible to grow fine asparagus plants from seed if care is taken to see that the seed bed is properly drained and well pulverized and that the seedlings are transplanted without too much injury to the root systems. But an established planting reaches the cutting stage much sooner if one year old roots of the best disease resistant varieties are used.

Before you make a planting you will find it a good idea to get introduced to the asparagus plant in the wild state so as to understand just what general conditions it finds most congenial. In the wild, asparagus thrives upon the banks of salt marshes in the temperate zone where the salt content of the soil is too high for many other plants. It will tolerate a certain degree of alkalinity but it will not succeed in an acid soil. Thus you will see that considerable quantities of lime placed deeply beneath the garden surface are usually necessary to offset acidity. You will understand, too, why salt sprinkled over the ground in which asparagus is growing to control surface weeds has no harmful effect upon the asparagus.

To establish a planting of asparagus you will find it best to select a site to one side of your garden. This site should be free from shade, the soil should be rich, deep, and well drained. The location should be so arranged that the permanence of the planting will not interfere with the cultivation of the rest of the garden.

In the spring as early as the ground can be worked, a trench twelve inches deep and about ten inches wide should be dug along the line where the first row is to stand. In the bottom of this trench place a three inch layer of mature compost humus and a generous amount of hydrated lime, say a half inch. If well rotted manure is plentiful this may be added. This layer should then be well dug into the bottom of the trench. The second row should be made not closer than four feet from the first.

One year old crowns should then be placed in position about eighteen inches apart and ten inches below the level of the garden. The crowns should be covered with a two inch layer of sifted compost humus and well watered. During the summer the trench should be slowly filled with a mixture of fine topsoil and composted material. Cultivation will tend to fill the trench, but you will find it advisable not to do the filling too rapidly or the growing plants are likely to be stifled.

Whatever care you take in the setting out will be well repaid to you later. The care you use in the selection of the site is an important item. The very careful, deep preparation of the area is of great value because the powerful fleshy roots of the asparagus plant often thrust their way five to six feet downward and spread out almost an equal distance in their search for the heavy supply of

plant nutrients needed for the production of the large spears. Because of this, the plants require more garden space than their feathery brush would seem to indicate, and because of the great depth to which the roots develop, you will find it wise to see that an ample supply of rich organic matter is deeply placed before setting out the crowns.

After the planting is established it will thrive with little care for many years. But as with all vegetables, asparagus should be kept free from the damaging influence of trees, it should be kept free from weeds, and each season it should receive a liberal supply of added organic material. This supply can be arranged in two ways.

In the spring the rows should be ridged. Ordinarily this is done by drawing up to the row a good quantity of the topsoil between the rows by using a hoe. If you use compost humus instead of topsoil to form these ridges, this will serve two purposes; it will bleach the shoots by excluding the sunlight, and it will add much valuable plant nutrients to the soil.

After the cutting season, it is good practice to sow a cover crop of cowpeas, soybeans, etc. These should be planted between the rows of asparagus. A cover crop of this type discourages the growth of weeds and when dug under adds greatly to the organic content of the soil.

But the organic material added during ridging is the most important. This ridge should be several inches high because if it is shallow the shoots will tend to open before assuming sufficient l e n g t h. Even if you decide to grow "green asparagus" that is, unbleached asparagus, you will find it necessary to form shallow ridges to overcome the tendency of the crown to get too close to the surface. This slow upward movement is caused by the formation each year of new storage roots on the uppermost side of the crown.

If a good growth is made the first year, it is possible to cut the shoots lightly the following spring, but it is generally better to encourage plant growth and to delay cutting for another season.

In cutting, place the knife blade close to the spear, run it downward the desired depth, then turn it enough to cut cleanly through the spear but no more. Careless jabbing during cutting time can cause very serious injury to a planting of asparagus.

As winter approaches t h e rows of asparagus should be lightly mulched with straw or similar material to prevent frost from penetrating too severely into the crowns. The brush should not be removed or burned but should remain as a part of the mulch. This mulch should be removed in the spring and the ground lightly cultivated.

By the time you have your planting of asparagus well under way you will learn that the asparagus beetle is considered a serious menace, that it is very difficult to get rid of and does much damage. But if you examine the habits of the asparagus beetle you will see that it is not such a terrible creature.

In the first place, most of the serious damage done by this beetle happens when the beetle is allowed to overwinter in the adult stage by finding concealment in fallen sticks, trash, leaves and the like. In this case it emerges in the early spring to feed upon the young asparagus shoots. Obviously, garden cleanliness and fall cultivation will prevent the insects from overwintering. Also, a very old method for controlling asparagus beetles was to turn chickens, ducks, guinea hens, etc. loose in the asparagus planting. These birds invariably do an efficient job of wiping out the beetles and their larvae.

Next you will hear about asparagus rust. This is a plant disease affecting asparagus. Small reddish pustules appear first on the main stalks. These pustules, when they burst, release a fine rust-colored cloud of spores. Sometimes an entire planting is rapidly infected and dies. But the degree with which asparagus rust does damage is very largely dependent upon local conditions. The spores require dampness for germination. Areas subject to heavy dews and damp mists are poor locations for asparagus.

But if you go more closely into the problem of asparagus rust you will probably run into a very interesting matter. .Of course, it is merely good sense to plant only strong varieties fairly resistant to rust, such as the Washington. But you will find that reliable authorities urge you to seek out and destroy by burning all wild asparagus plants growing near your garden. These wild asparagus plants, they will tell you, are very dangerous sources of infection from which the rust may spread to your garden.

If you find one of these wild asparagus plants, you will likely be filled with admiration. Here is a plant whose feathery brush reaches almost as high

as your head; its great stalk almost as large as your wrist. This is the plant you are advised to destroy. By this time you will be wondering how this plant, fighting with other plants for a place in which to grow, attacked by rust, and subject to all manner of plant and insect pests, can yet be so fine and sturdy.

Can it be that the natural organic conditions, with their steady supply of naturally composted material coming in season after season, freedom from the slight injuries of transplanting, freedom from the root injuries caused by the tools of cultivation, freedom from chemical stimulants—in their place only the natural mulch of the wild—are the answer to this question?

My Experiences and Opinions on Indore Composting

By Lady Eve Balfour

From NEWS LETTER ON COMPOST (England)

COMPOST in general in recent years has become a controversial subject—the "Humus versus Chemical" controversy. The issue is fundamental. Nature, when she is not interfered with, usually manages to maintain a satisfactory balance of species. When this balance is upset, troubles result. Now, Man is the only species that has developed the power seriously to interfere with Nature. There are two kinds of interference. One follows the general lines of co-operation and recognizes that Man is part of Nature and must conform to her laws. The other puts itself in opposition to those laws. This must always be a losing game, because it ends in self-destruction.

Any apparent success is really illusory—as illusory as the apparent success of the acrobat who seems to lift himself up by the seat of his own pants. Man cannot "conquer" Nature, because he is a part of it.

Our task is, not to fight Nature, but to try to understand her. At present our understanding is in its infancy.

Certain things emerge clearly from a study of natural laws and Man's past behavior. One is the danger—as expressed in an annual report of the Bureau of Animal Population—"of ordering the destruction of a species, on the chance that it may be doing harm to human interests." Jacks and Whyte, in "The Rape of the Earth," that masterly review of soil erosion throughout the world, point out that "we cannot condemn the prairie gopher, the Australian rabbit, the African termite or the locust, without first discovering to what extent, if any, some action of Man has upset an equilibrium in animal ecology, and, therefore, indirectly in plant ecology, and so affected the conservation of vegetation, soil and water." To this list might well be added caterpillar, aphis, eelworm and a host of other pests and parasites.

Now, what do we do when we receive visitations of these pests? Instead of trying to discover whether Nature's equilibrium has been upset, whether we are responsible, and, if so, in what direction we have been at fault, we set about attempting the destruction of yet another species, thereby still further deranging the natural balance. But in the disorders of all living things, plants, animals or man, prevention is better than cure, and prevention must begin where all life begins, in the soil.

Now, soil is itself a complicated ecological system. The number of microscopic plants and animals living in it has been estimated to reach tens of millions to the saltspoonful. It should be clear, therefore, that any adequate study of the soil, the rooting medium of all our crops, requires the application of three sciences, not only chemistry and physics, but also biology. Of these three, indeed, biology is the most important. In recent decades this fact has been ignored—or forgotten. In our soil treatments

we have disregarded the importance of maintaining the biological balance in soil. The life in the soil is its most important property; on it depends its physical condition, and much of its power to maintain the higher plants. I am not referring to plants grown under controlled laboratory conditions, but to those growing in open competition in the field. For these are the conditions under which the majority of our food crops must always be grown.

In modern practice the chemical properties of soil, which should probably take third place, have been put first; and soil treatments are governed by consideration of plant nutrients only, without any regard to their effect on the soil population. In fact, more often than not, we ignore the very existence of the soil population, except to make war on certain species that we regard as harmful. This is foolish, for the soil legions, when given a square deal, form an allied army as powerful as it is large. Moreover, it will undertake most of our policing for us, a much better solution of the problem than gassing the criminals, for that would involve gassing our friends also.

Who are these friends and what can they do for us? To speak of two only—earthworms and soil fungi—these are among the most important natural allies of man. I want to remind you of a few of their activities.

Earthworms can number anything up to 8 million to the acre, their numbers depending very largely on soil treatments. Mechanically, they are the world's best subsoilers. They can burrow to a depth of six feet, and render soil permeable to rain, which helps to check surface water-logging. As aerators they are superior to mechanical subsoiling implements, because the soil which they bring to the surface—and Darwin calculated that this amounted to as much as ten tons per acre per year—is not crude material, but neutral colloidal humus—the only kind directly available to higher plants. This is a manufactured product, derived from the soil and organic matter which they swallow, crush in their gizzards and finally cast out well mixed with digestive secretions.

The work of soil fungi is even more diverse. Certain groups are among the principal agents concerned in the decomposition of cellulose—the non-soluble wall structure of living cells. Certain fungi perform this function of decomposing cellulose not only in soil, but also in the digestive tract of many animals. These fungi can utilize complex organic substances, not available to higher plants, and break them down into simpler forms which those plants can use. Other groups protect both plants and animals from parasites, literally by capturing and eating them. Others again contribute directly to the nourishment of certain higher plants by forming association with their roots and penetrating into the root cells, which subsequently digest the intrusions. The exact nature of this association is still undergoing research, and has not yet been fully established; but it is no longer in doubt that the host plant benefits by the invasion of the fungus. In addition, there are now very strong indications that some by-product of the activity of soil fungi in general, whether in direct association with the roots or not, acts as a growth-promoting substance to the higher plants. There are further indications that it is upon this part of their diet that plants, growing in open competition, derive their powers of disease resistance; and that this is a quality which can be transmitted to the animal kingdom.

Evidence on these two points is steadily accumulating. Enough is already known to furnish strong reasons for believing that the health of plants, animals and man is bound up with biological soil activity. If this be so indeed, then every encouragement should be given to the soil population; especially that portion of it known to be beneficial.

The danger in chemical fertilizers for promoting growth and poison sprays for controlling pests is that by their use we are liable to kill these unseen friends of ours, with ultimate consequences that may be far-reaching and serious. That both earthworms and soil fungi are highly sensitive to many chemicals in common use as fertilizers can be demonstrated. Earthworms will desert land heavily dressed with artificials; and soil fungi, if not actually killed, are largely inhibited by them.

The issue is between a live soil or a dead one—the relative importance of the chemical and biological aspects of soil fertility.

With this in mind, the Humus v. Chemical controversy falls into proper perspective. Humus is necessary to the soil organisms which benefit the higher plants. It must include substances of animal origin, because soil fungi cannot subsist on a diet composed of inorgan-

ic salts: they are not even purely vegetarian.

The beneficent action of compost—which is manufactured humus—is due mainly to its biological properties—far more important than its chemical composition or even to its physical properties, important as these are.

Different composts of almost identical chemical composition can produce very different results. Chemical activators seem to be markedly less effective in producing a compost conducing to disease resistance than activators of animal origin. If this quality is derived from the direct, or indirect, activities of soil fungi, this is understandable.

Composts, then, must be thought of, not so much as providing direct plant food, as encouraging desirable soil organisms. This explains why exact procedure in compost-making is essential. Obtaining the correct temperature, for instance, is of critical importance to the value of the final product, for different temperatures encourage different soil organisms. The methods of ensuring correct temperatures vary according to the system of composting adopted; but whatever the method, all successful compost-making has one indispensable rule, decomposition, whether in the heaps or pits, must take place by fermentation; and not by putrefaction. This is achieved by careful control of the moisture content and air supply.

I employ the Indore method. It is very adaptable, and I have found its results to be excellent. Farm conditions are very different from those of allotment holders; but the principle remains the same. The compost heaps are built up in layers, first six inches or so of whatever waste material of vegetable origin is available. Practically anything can go in that is not required for salvage. All garden wastes and rubbish —composting banishes the bonfire—any kitchen waste that is unsuitable to feed the livestock; household dust, sweepings of all kinds, straw and chaff if you can get hold of them; grass clippings—all or any of these will do. If several different kinds are used in the same heap they should be well mixed, and the amount of fresh green material must not exceed 30 per cent of the total. If there be more available, then let it wither for a few days before it is used.

Next comes a layer of some form of animal residue. Any kind of farmyard manure, if it can be got; pig manure, or poultry droppings or rabbit manure or blood; or bedroom slops may be used for moistening the heaps. The thickness of the animal layer depends on the material used; if farmyard manure, as this will contain a proportion of straw or other litter, the layer should be about 2 inches thick. If poultry manure be used, a thin sprinkling will be sufficient. If only liquid be available, as blood, or bedroom slops, dilute it with water and wet the vegetable layers with it as they are built. Next comes a sprinkling of soil. Use the best soil you have; if you can mix a little chalk or slaked lime, or wood ash with it, so much the better. In city allotments broken plaster rubble will often be available.

Those are your three layers: then you start all over again, vegetable layer, animal activator and a sprinkling of soil. Continue like that until the heap is high enough, and then cover it with a good layer of soil.

In large heaps, such as we make on the farm, which measure 10 ft. by 5 ft., by 5 ft. high, it is necessary to make ventilation holes to ensure a sufficient air supply. This is rarely necessary in small heaps; but if you decide to do it, the easiest way is to stick up two stakes lightly in the ground, and then to build the heap round them. When the heap is finished, you work them from side to side, to enlarge the holes, after which it is quite easy to draw them out. In any case, whether or not ventilation holes are provided, it is important to build the heaps as loosely as possible, and not to stand upon them.

Now as to site, and size. Choose a sheltered site, and build the heap on the bare ground, not on a cement or other floor. In fact it is a good plan to fork over the ground before composting begins. This facilitates invasion of the heaps by earthworms, which should always be encouraged, not only because they help in the decomposing process, but because their presence is one of the signs that the process is going well.

On the farm we have sufficient material to build our heaps in one operation, which avoids one difficulty, to keep in the heat, with which the small scale composter is faced. One good way to get over this difficulty is to build a compost box of rough boards about four feet square by four feet high. This box has neither top nor bottom, but only sides, three of them fixed to uprights, and the fourth composed of loose boards. These are dropped in as the material inside the box

rises. The boards comprising the fixed sides should have spaces between them, to allow the air to get in. The box is filled in a series of layers as already described, but as each layer is added, it is forked over and so mixed with the preceding layer. When the box is full something should be put over the top to protect it from rain, an old sheet of tin, or an old door, or even old bags.

In large heaps, such as we make on the farm, two turns are necessary; the first, three weeks from making the heap, and the second in a further three weeks. When made in small heaps or in a box, one turn is usually sufficient. The total time taken from first making the heap to when the compost is ready for the land is three months.

When turning the heap—if it is made in a box you simply transfer it from box to heap—care must be taken to put any dry, unrotted material from the outside into the middle, also to break up all lumps, and to water again if necessary. The material at this stage should be as moist as a squeezed out sponge. Throughout the process there is never any unpleasant smell, and when it is finished, the compost feels, looks and smells like old leaf mold; this remains true, no matter what the animal activator used, whether pig manure, poultry manure, blood, or bedroom slops.

Now unless the compost is to be made very scientifically with the aid of a thermometer, it is necessary to know the signs that indicate that the process is going well. A few days after completion, the heap should begin to warm up. This can be tested by sticking a poker into it, and feeling if the poker is hot when pulled out. Ventilation holes should steam profusely. After a week or so the heap should have settled from five feet to about three feet—or the equivalent in the case of smaller heaps. When the first turn is given, fungus growth, looking like a grey mildew, should be evident throughout the heap. When this fungus forms actual toadstools on the surface of the heap, as it often does, that is an excellent sign.

If none of these good signs is present, the heap is too wet, too dry, or too tightly packed. Experience soon tells the mistake.

Does compost do what is claimed for it?

There is now a very large body of evidence on this point, but I shall confine myself to telling you of three instances, picked from my own personal experience. I will give one each, concerning plants, animals and man, instances of practical interest to allotment holders.

I have now tested the effect of compost on members of the cabbage family for sufficient seasons to be satisfied that, if the seedlings are raised on soil rich in humus and transplanted on to well composted ground, they will resist attacks by caterpillar and aphis. Or, to be more strictly accurate, they will quickly throw off such attacks without the assistance of insecticides. Moreover the growth of such plants is second to none, and the flavor markedly superior.

For my animal example, I have chosen my experience with young pigs. These animals, if kept shut up in sties or houses, which is the only way that they can be kept by allotment holders, are very subject to White Scour which attacks them when they are about a month old. I have proved to my satisfaction that if these young pigs are kept supplied with fresh soil from fertile land, that is, rich in humus and where no chemicals have been used, they do not suffer from this trouble. The soil should first be given when the pigs are about a week old, and should be continued up to the sixth week. You would be surprised at the large quantities that these baby pigs consume. Now here is the interesting thing. If the soil be taken from land that has received the usual dressings of chemical manure, and no compost, it is quite ineffective either as a prevention or cure for this complaint.

Lastly, as my human example, I once more take my own experience. Before I started eating compost grown food I always suffered from rheumatism in the winter, and was subject to constant head colds. After changing to compost grown food my rheumatism disappeared, and I now practically never have a cold. I have now been over a year without even a slight one.

The Decline of American Agriculture

By Ehrenfried Pfeiffer

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ACCORDING to the "law of the minimum," the mineral nutriment present in the soil in minimum amount determines a plant's growth. If, for instance, a plant is abundantly provided with such essential chemicals as potassium, nitrogen and calcium salts, but lacks phosphates, it will suffer in proportion to its phosphate deficiency. The discovery and application of this law figure prominently in the history of chemical agriculture.

But the concept of this law is being biologically extended. It is becoming a "life" concept. First, progressive agriculturists grew aware of chemical deficiencies; then of deficiencies in such rare metals as zinc and copper; but we still had poor crops, erosion and dustbowls, for now it was the soil- and moisture-holding humus which was "present in minimum." Whereupon more attention was given to a proper, soil-conserving crop rotation, with special emphasis on leguminous plants. But still the concept was not wide enough. Something was being neglected: man.

In agriculture—since it is a complete system—the "law of the minimum" covers every life-fostering factor; and man is a life-fostering factor. Indeed, his contribution to the process of growth is enormous. Left alone, nature would try to create a balance of vegetation in accordance with outer circumstances such as climate and soil, or, if the situation were hopeless, abandon it to desert; but would never grow "crops." Man grows them for food and raw materials. He owes his existence to partial separation from nature and lives as he pleases. But the forcing of nature in crop-growing disturbs nature's balance, and requires the taking of certain steps to restore the soil to health. Thus man's understanding or not understanding and cooperating or not cooperating with nature come under the "law of the minimum;" and, while considering the chemical interrelations between plants, soil, water and air, and the "dynamic" interrelations between light, warmth and the heredity and spontaneous mutations of seeds, we cannot with impunity forget the most important factor of all: man himself. If one factor in a vast complex, we have said, is "present in minimum," the whole will be thrown out of balance. Today it is man who is "present in minimum" —and we are beginning to reap the consequences: duststorms, floods, soil erosion, sickly crops, rapid desert-formation, degeneration of plants and an increase of pests.

In this agricultural tragedy, America plays an important role. For it was America which brought to agriculture an extreme mechanization. Compare the humanity-crowded, hand-hoed fields of the Near and Far East with the "empty" tractor-worked fields of the average American farm, where one man is made responsible for a hundred or more acres. "The machine has replaced man," we say—and strain toward that time when all hand labor which can be assigned to machines is so assigned; when man is little more than the servant of the machines he invented.

Is this good—this suppression of man's creative function in the life of nature?

Luther Burbank, the California plant wizard who has created many new plant forms, said one day: "It is finally I, the human being himself, who gives birth to plant life, who puts in the seed, changes the forms. Man is the determining factor who gives life or takes it away."

Man's destiny is to become the master of nature: something higher than his present role of pupil and experimenter; to use nature as a tool.

But apprenticeships are beset with difficulties: major or minor catastrophes which, coming at the end of every period, and provoking not only pain but a deeper understanding, invite a forward step. If the apprentice ignores any factor

in the complex of his work, he may fail of his aimed-at mastership—and today, because of man's overemphasis upon machines, and increasing underestimation of that factor which is himself, he and the whole of agriculture face a grave danger.

For many things on a farm cannot be done by machines, such as feeding, looking after animals, stable-cleaning, weeding, combatting pests, and milking.

The latter furnishes an especially good example. A person who has never learned hand-milking can assist at a mechanical milking, but does not understand the finishing off by hand, the all-important "milking out"—the very process which determines the health and production of the cow.

Present-day farm labor is poor in both quantity and quality. The situation has been aggravated by the draft, and by the disproportionately high prices paid for workers in Defense factories, as well as by the widespread notion that skilled farm labor can without hurt be replaced by the unskilled—even boys and girls of teen age. The younger generation of helpers, machine-minded and machine-educated, feels embarrassed when asked to do hand work, and often refuses; with the result that they handle inexpertly such tools and implements as the scythe and sickle, the team-dragged plow and the sharpener for the blades of a mowing machine—as if driving a tractor only were identical with farming.

But perhaps most of the blame for this exodus from the land should be laid on a psychological factor. Man has lost or is losing his appreciation for nature. Taking it for granted that he will always be provided with an abundance of everything, and liking the spectacle of others working for him, he disassociates himself, mentally as well as physically, or physically because mentally, from the land—setting down, satisfied, in man-made, technical surroundings and to an artificially constructed life. Monotonous city sidewalks, factories with rattling machines, a crowded downtown office lit almost all day by electric lights: any place for work seems preferable to the always fresh air and wide horizons of a farm. Nature is in a kind of Cinderella position.

Thus do values get all mixed up in the mind of man.

What will happen within a few years after the older, land-skilled generation has died out? This is a serious question, troubled over by many a conscientious farmer. Industrialization and city life teach little farm lore. Refinements of soil treatment and "complicated" soil-building crops may be progressively abandoned, with only a few "mechanized" crops surviving. Before extreme standardization, colorful diversified farming tends to go down, and one-sided crops, as monotonous to the soil as to the eye, exhaust the soil's fertility. Anticipating this, the farmer of 1943 is developing a "Goetterdaemmerung" mood. He fears he is getting a pretaste of dreadful things to come.

About the plight of the farms the city man worries less. Yet he has plenty of cause to worry, for does not history offer conclusive proof that the life-blood of a nation derives from its rural population? This is particularly true of a "young" country like America, where most of our great grandfathers and grandfathers were still connected with the land. In Europe many centuries-old families have survived largely because of their unbroken contact with the earth, that source of regeneration. Statistics, as published by O. E. Baker of the Department of Agriculture, demonstrate that it is the rural rather than city populations which lead in replacing a nation's losses through death. Baker mentions the period between 1950 and 1960 as a kind of climax, the time when the death rate will have outdistanced the birth rate, in the United States, and the population begin to decline.

The fate of France is a terrible object lesson. An increasing urbanization, together with an idea of "security" which ignored that greatest security of all, a self-sustaining farm, created an urban proletariat; and, for lack of proper help, more and more farms had to be abandoned. Future historians will see in these matters some of the reasons for the fall of France.

Just before the outbreak of the Second World War, the author discussed bio-dynamic farming and gardening methods with the Director of the French Ministry of Agriculture, emphasizing particularly the necessity of maintaining the land's fertility by means of a long-range agricultural program. The conversation ended thus:

Mr. B.: "You talk, Dr. Pfeiffer, like someone who wants to establish a dynasty of peasants. But what are we to do today with those who want to make a profit, and for whose profit we are responsible?"

Pfeiffer: "If a long-range agricultural program on a biodynamic basis is not set up, the fertility of the land and the health resources of humanity will suffer. Thus the possibility of a renaissance of the French nation depends upon a dynasty of peasants coming into existence. If one worked only for monetary gain, one would live at the cost of the capital of the earth's natural fertility. The nation would then be of short duration. It is part of the Minister's responsibility to determine whether the short-term gain will cheat the country in this regard, and what measures, if any, should be taken to insure durability for the coming centuries."

Two years later, in the wake of unspeakable catastrophe and suffering, we read:

"Vichy, July 3, 1940. Guiding Principles of the French Labor Ministry for Reconstruction: a. France is above all a nation of peasants and artisans. These occupations, all too long neglected, must revive. A sensible balance between peasant and industrial economics must and shall be found. b. All non-specialized workers whom war drew away from the land must be brought back to the land. c. A general policy of repopulating the land must be taken up. French soil can give employment to and feed many more people than in recent years."

What immense suffering could have been avoided if France had followed such a policy fifty years earlier! If the French had remembered that farming is still the "profession royal," in that it protects the water-supplies, provides the human being with almost all the necessities of life, and maintains (and this is perhaps as important as our bodies' welfare) the surface of the earth in a state of fertility consonant with adequate surroundings for human culture!

What does it all add up to?

The fact that agriculture all over the world, but especially in America, is threatened by death, is in a dying state, but can by proper treatment be raised up again to health. The "treatment" in this case is a more fruitful philosophy of the land—one which reverses the wheel of retrogression.

Unfortunately the human being has developed a psychological peculiarity. Neglecting necessities, he prefers theories, ideologies, trivial hobbies, even illusions—as if these are the realities, and necessities only the burdens from which to escape. History has been a series of escapes and returns.

But there is a comforting thought. It is not yet too late; and the war years are helping us to see the gravity of the situation—to see how quick is the drop from abundance to shortage.

The whole problem is primarily a moral one. Our future depends upon our choice between death forces and life forces; upon whether or not we will return in humility to the soil. The great questions are: Will we return to a philosophy of life which lays stress upon growth? Will our youth be educated in the spirit of growing things, and of service to life? Will they learn that it means more than money to plant our seeds and harvest our crops? If the right inner attitudes toward the soil penetrates the human race again, a renaissance of rural life will begin, and not only will new resources be created for our population, but spiritually we will be "safe."

Surely our youth, returning from the horror of destroying (or is it a pleasure, a lust?), will appreciate the spirit of life if it is presented in a constructive way—the spirit of allowing things to grow, of building up, which has sunk to a "minimum."

The desire to rebalance Man and Nature should be in our souls a hunger and a thirst.

Anent Peaches

It isn't necessarily the largest peach in the basket which has the most ascorbic acid content. Schroder, Satterfield and Holmes found no correlation between the size of the peach and its ascorbic acid content. There was an average variation within the same variety of 4.29 mg. per hundred grams of fruit, and the differenct between varieties in extreme cases ran as high as 9.02 mg.

The highest concentration of ascorbic acid in peaches was found to be next to the skin, lower in the flesh directly under the skin, and lowest in the flesh surrounding the pit. As the peaches ripened, the Vitamin C content increased to its maximum state.—*Hospital Topics.*

Composting Sawdust

By Sir Albert Howard

From the "GARDENERS' CHRONICLE"

JUDGING from the number of enquiries which have been reaching me of late about the use of sawdust in making Indore compost it occurs to me that the readers of *The Gardeners' Chronicle* may be interested in the recent results obtained at Levens Hall, in South Westmorland, where the whole of the large kitchen garden and a considerable area formerly devoted to flowers are now being used for commercial vegetable growing in support of the local "Grow-more-food" campaign.

The Indore Process has been adopted for more than a year at Levens Hall and, although the previous reputation of this garden stood very high, nevertheless there is no doubt that systematic composting, in spite of the short labor supply, is leading to even better results.

For some time the head gardener, Mr. F. C. King, has been making full use of the sawdust produced at the nearby sawmill for adding to the ordinary mixed vegetable wastes. He has very kindly recorded his results in the following letter, dated May 18, 1943:—

"In reply to your enquiry as to my system of using sawdust in compost, the best results are obtained if the sawdust is spread out in a yard or any vacant piece of ground near the site of the compost heaps. Cover the area to a depth of about three inches and leave it for a couple of months or so. I always make a point of spreading sawdust around any heap or farm yard manure or round compost boxes to absorb any liquid which might otherwise run to waste during wet weather. When making up a compost heap I use about five per cent by volume of sawdust which has been spread out to weather. The size of my heaps varies from about forty feet long and nine feet wide to forty feet by six feet, according to the material available. I compost everything I can get including coltsfoot leaves and roots of ground elder, couch grass, dandelions, thistles, nettles and docks. Bottles and tins are picked out when the compost is ripe and is being wheeled to the garden. In the heap they are most useful in keeping the mixture open to supply air.

"I have used approximately 50 tons of compost this year and have that quantity ripening for further use. I hope to have still another 50 tons ready for the garden by October. Some will be used for growing mushrooms and the rest will be spread thickly on ground I am preparing for salad crops under cloches. With ground rich in humus a crop of lettuce matures in six weeks from planting, whereas on ground not generally treated with compost I find it takes eight weeks and the crop is not so good. I seldom get *Botrytis* or mildew. The seedlings are planted on the flat even in winter.

"Sawdust prevents the soil from becoming sticky, or caking with sun heat, and if the amount of sawdust used is limited to five per cent of the composting material, a first-class product is obtained. As a summer mulch I find it ideal in every way. If dry sawdust is used among the material going into a compost heap, it does not seem to mix so well or to decompose quickly; but if spread out thinly and allowed to get wet it turns black very soon and then mixes well with any other available material."

The other day I saw a batch of weathered sawdust ready for going into one of the large bins in which Mr. King conducts his composting. It was almost black in color. Some freshly prepared humus in which weathered sawdust was one of the constituents showed no sign of the original material.

Mr. King's experience agrees with what took place at Indore in Central India while the Indore Process was being devised. I invariably placed

all the sawdust and wood shavings from the carpenter's shop in a vacant compost pit and kept the material moist for ten days or so before adding it to a new heap. Not more than five per cent of sawdust was ever used in the mixture. As sawdust is rich in lignified cellulose and as lignin is an important factor in humus formation, full use might be made of sawdust in composting on the lines so successfully adopted at Levens Hall.

Starting the New Garden

By Roger W. Smith

GOOD vegetable gardens are built, they don't just happen. Much of their productiveness is the result of the wisdom and foresight of the gardeners who planned and built them. If you would get the most out of your efforts at growing vegetables, you might like to form an idea of how a good gardener plans and builds a new garden.

First there is the selection of the place where the garden is to be built. This selection is most important, for many garden crops fail because of poor site. Briefly, the ideal spot for a good vegetable garden is a piece of open, treeless ground sloping gently to the south or southeast and protected at its northern end by the crest of the ridge or a distant woodlot. You might not be able to find the ideal spot but if you know its requirements that knowledge should serve you well.

The area should be well drained, that is, water from surrounding areas should not run on to it; water should not have a tendency to form persistent pools upon it after rain, and there should be no danger of river water flooding it.

No trees or buildings should be within fifty yards of the area selected with the exception of a windbreak near the northern end, and that only in places very subject to strong unseasonal winds from that direction.

It is very convenient to locate a garden near the house. This is usually a very bad plan. Often a garden suffers from such a choice for several reasons, the house and the trees which are invariably planted around the house, shade and rob the garden of its share of moisture. Such a garden is often poorly drained, seldom open, sunny and well ventilated. You will find it wise sometimes to turn the old garden located near the house over to the apple trees and choose a new and better site. Some vegetables can withstand a certain amount of shade but practically all of them do much better without this handicap.

After you have selected the site you will be free to study the type of soil it contains. Any fairly good soil can be made productive provided the site meets the other requirements. A sandy soil warms up more quickly in the spring. A heavy clay soil will warm up a bit later but will likely be more retentive of moisture and therefore be better able to carry a crop well during a prolonged dry spell.

If you dig a few deep holes over the site you have selected you will easily find out the depth and quality of the top soil and whether the subsoil is composed of stones, clay, sand, etc. Often the depth of the topsoil is surprisingly slight. If the top soil is of sufficient depth it should be double dug. In any event the top soil should be turned over and the subsoil broken up. This is best done in the fall.

Some gardeners would simply plough it and leave it in the rough over winter. Others would go to the other extreme; they would remove the topsoil entirely, break up the subsoil, plant a cover crop upon it and dig this in whilst is was still succulent, and then add the removed topsoil which had in the meantime been c o m p o s t e d with other material sufficient to form a new topsoil around three feet deep.

You will be likely to adopt a middle course, that is to dig a trench along one side of the area and place the removed topsoil aside, then dig another trench in the bottom of the first to reach the subsoil but not to

bring up too much of it. The subsoil should then be broken up, and upon it a generous layer of composted material placed as well as the sods which were removed in the digging. A second trench should then be dug alongside the first and the pulverized topsoil removed from it used to fill the first trench.

This matter of digging might seem to you an arduous task. There are a few points about even the simple task of digging a garden that are worth noting. In heavy soils a spading fork is a much handier implement than a spade and more efficient in the matter of breaking up the clods after they have been lifted. In the actual process of digging the spade should be driven into the soil by the *weight* of the body exerted by placing a foot upon the shoulder of the spade and standing upon it if necessary. The spade handle should then be forced back not by pulling but by leaning upon it and forcing it back by the *weight* of the body.

Actually skilled digging is a rhythmical and rather enjoyable process. After all, it is worth remembering that you have all the time in the world. Dig a few rows today. Decide to do a little tomorrow. Take it easy but do it thoroughly. If the topsoil is very shallow add more material in the bottom of the trench even of you have to bring in a few loads of topsoil from the surrounding area. After the site has been built up it should be left in the rough over winter, to be further pulverized by the action of the weather.

The more good composted material you can add in the initial preparation, the swifter the garden will reach its maximum fertility. The more care you take in its preparation, the more complete will be the metamorphosis from an area of sod and untrammelled weeds to a controlled, rich garden soil. If you do not have sufficient composted material on hand, well rotted manure and similar materials deeply placed will have to suffice.

Originally "manuring the land" meant "maneuvering the land", and this in turn meant hand working it, that is moving it and working it up to its best mechanical condition. In the old days the soil was deepened and crumbled by digging and trenching and its physical condition improved by the addition improved materials. manure and bedding from stables, cow barns, piggeries, and hen houses. Usually these were added at the rate of about thirty tons to the acre, and through their use the soil condition was improved and enabled to make better use of water and the plant nutrients it contained.

We know now that this procedure was right in principle but that much better results are obtained if stable manure, straw, leaves, and the like, are first composted rather than being incorporated in the soil thus forcing the soil in the garden to digest them at a time when it should be busy supplying the results of this process to the vegetables growing on it. But it is important to note that it is open to question whether the fine results many good gardeners obtain is not brought about by what they do to the soil, the way they handle and move it around, quite as much as by what they add to it. Too many gardeners miss this point. They are led into a common error. A quart of chemical powder is *not* worth a truckload of stable manure. On the other hand raw manure becomes of value to the growing plants only after it has been broken down and made available to beneficial soil bacteria.

You will realize, after you establish your vegetable garden, that deep digging year after year, (unless the subsoil is so sandy that it is necessary to go lightly to keep it tight and water-holding), that adding generous quantities of composted material, adding due quantities of grit or sand if the soil is very clayey, peat moss if it is exceptionally sandy, almost any type of soil may be built up until it is highly fertile and productive. Naturally, you will not overlook the use of ground limestone to offset excessive acidity.

And as time goes on the layer of topsoil should gradually deepen. This deep layer of humus is the garden, the rest, the framework in which it stands. But this humus is a variable substance. It should be soft and friable, pleasant and clean to the touch, healthy. The beneficial bacteria which it contains will not work unless they live under proper conditions. Plant tissues are being acted upon by them. If they can breathe, that is if they have access to oxygen, these bacteria liberate mineral salts through their activities. These mineral salts have great plant value as nutrients, they are mineral salts in a form in which the plants naturally receive them. The addition of chemical, inorganic salts as this juncture does much to upset the delicate natural balance and hinder the activity of these beneficial bacteria if not to destroy them al-

together.

All these are matters which will come to you as you build and arrange your new vegetable garden. The thing to be sure of is that your garden has plenty of good sunlight, proper drainage, and that the topsoil is built up to a layer of humus at least double the depth your spading fork will reach. And in the Spring when you dig and rake your garden, and the snow birds are replaced by the little song sparrows, you will have the satisfaction of seeing laid out before you the results of your handiwork. Surrounded by weedy grassland lies a rectangle of dark, rich earth, pleasant to the touch, soft to step upon. It has a pleasantly fresh aroma. It promises much. It is your garden.

Earthworms Play Jack Straws

By Alice L. Dustan
(Conn. Agric. Expt. Station, New Haven. Conn.)

HAVE you noticed straws or leaf petioles sticking upright in the lawn? "Earthworms playing jack straws" is the explanation Dr. L. C. Curtis of the Connecticut Experiment Station, New Haven, gives for the phenomenon.

Well, it's not exactly that, Dr. Curtis goes on to explain, but earthworms are responsible for the unusual position of the straws, twigs or fallen petioles, and even leaves, bits of paper, feathers and pebbles. These terrestrial animals use the "jack straws" to stop up their burrows. Occasionally the softer parts of plant material serve as food. Emerging at night, the worms drag the material partway into their hideouts, presumably to prevent the entrance of water during heavy rains, or it may be to conceal their burrows from marauders or to keep out the cold air at night.

The earthworm is man's friend, not only as fish bait but also as a soil conditioner. Considering its size, a worm swallows an enormous quantity of earth while excavating its burrow and consuming soft bits of vegetative matter in the soil. Lacking teeth and jaws, it cannot bite off leaves or shoots of living plants, but exists for the most part on semi-decayed material. Its digestive system, like that of a chicken, includes a crop and gizzard, the better to masticate its food.

Examination at the Experiment Station shows that the castings which are deposited on the soil surface contain plant food elements in greater quantity and in a far more available form than that of the surrounding soil. Nitrate nitrogen in castings is almost five times more abundant than in the top six inches of soil. Available phosphate is seven times greater; available potash, 11 times; and available magnesium, three times. Humus is about 40 per cent greater than in topsoil. Someone has figured that one earthworm will produce about 8 pounds of castings in a single season. Wise gardeners, therefore, will encourage the multiplication of earthworms in the soil. The addition of an organic mulch to the top of the soil is the best way to do this.

Charles Darwin in his 60-year-old classic, entitled "The Formation of Vegetable Mould Through the Activity of Worms, With Observations on Their Habits," pointed out the earthworm's value to agriculture: "The plough is one of the most ancient and most valuable of man's inventions; but long before he existed, the land was in fact regularly ploughed, and still continues to be thus ploughed, by earthworms. It may be doubted whether there are many other animals which have played so important a part in the history of the world, as have these lowly organized creatures.

"Worms prepare the ground in an excellent manner for the growth of fibrous-rooted plants and for seedlings of all kinds", he further explains. "They periodically expose the mould to the air, and sift it so that no stones larger than the particles which they can swallow are left in it. They mingle the whole intimately together, like a gardener who prepares fine soil for his choicest plants. In this state it is well fitted to retain moisture and to absorb all soluble substances, as well as for the process of nitrification."

Earth for Compost Heaps

This is a reply to a letter from one of our readers who seemed to be at a loss where to secure earth to be used in making compost heaps.

Dear Sir:

Replying to your letter of September 30th, I will admit that the obtaining of the necessary amount of earth for making compost heaps is the biggest stumbling block in the way of making these heaps. On the other hand, the farmer can solve this problem, but he will have to use his wits.

I want to tell you how we at Rodale Farms have been getting our earth. In the first place, we go along the ditches all along the side of our farm and recover all of the top soil that has been washed off. This represents a considerable amount of earth each year. We, from time to time, have been getting some earth from the woods, being careful not to take too much from any one place. We have obtained a large quantity of earth from the building of foundations for chicken houses and other farm buildings that we have put up. We have never yet gone out into a field and taken any top soil to be used for this purpose.

We have recently discovered another place to get earth. Where a corner of our farm intersects with the highway, there have been a few automobile accidents and we have found that this has been due to the fact that our land comes very close to the highway and it quite high at that point. It, therefore, does not permit a view of the cars coming from the other side of the road. We intend, therefore, to take down some of this earth to permit us to get a better view of the main highway, thus reducing the hazard of accidents and giving us a large quantity of earth for compost heaps.

Perhaps you have a chicken house that is built on the ground. You might be able to dig under it for a few feet, getting the earth from under it. There must be many other sources of earth.

Another method of securing soil on a farm is to take it directly from lanes or roads in the farm. Where the soil is taken off, the void is filled in with ashes, cinders or rocks.

Where the amount of earth is limited, it should be used more sparingly in the compost heap. The purpose of using earth is to inoculate the compost heap with the bacteria that the earth teems with. Rich top soil contains billions of bacteria and speeds up the process of decay of the heaps.

While writing this reply to your letter, a thought occurs to me, which might be worthwhile trying and I will explain to you how this thought originated.

In our steer barn we have about twenty steers which are bedded down with straw. Steers are not kept like cows but wander all around in the barn and also have a small outside pen to which they have access, to get the sun. Our practice used to be to clean out the manure every two weeks and make compost out of it. Due to the man-power shortage, however, we found that we were unable to clean our barns that often. Someone made the suggestion that many people, as a regular practice, allow this manure to accumulate in the barn. In other words, every week new straw is put down over the old manure and the barn is not cleaned out until about three months later. By that time practically all of the manure has rotted underneath and has practically turned into compost. The urine of the steers, which is constantly added also, seems to help along the process of decay, giving it enough moisture for that purpose. This is the second year that we have followed this method now and here is what we have noticed.

The first three month period last year, the odor in the barn, due to not cleaning often, was quite pronounced and noticeable. In our last three month period, which is just about coming to an end, I have noticed that there are absolutely no odors from the manure in

the barn. This is rather unusual because anyone who hangs around barns knows that odors are to be expected. Anyone who works around compost heaps, knows that there should be no odors in the process of decay. The fact that there are no odors in our barn is a sign that the composting of the manure is proceeding effectively and naturally.

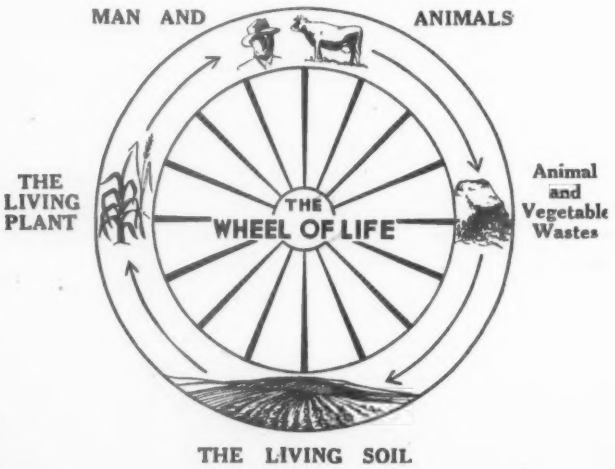
The answer is probably that when we cleaned out the last batch of rotted manure that some of it was left and not cleaned out with the result that the old, rich, rotted compost contained so much bacteria that they immediately started to work on the new manure. From now on, therefore, we will always be careful when we clean out the stables, to leave a small amount of the old compost. In cleaning out the stables also, it is important to take off the few inches of the top land that are not rotted and place it aside for other use.

Now what has this got to do with your problem? Where there is no earth available or very little, my suggestion would be when a heap is finished, to save some of the compost for inoculating the new heap. In starting the new heap, place a thin layer of compost on the bottom, perhaps one inch. Then you would place your green matter, after which comes the manure. I would put a very thin sprinkling of the old compost on top of the new manure. By sandwiching in on the heap these very thin layers of old compost, I believe that will accomplish the work that the earth was intended to perform. It would always be advisable to have a small amount of earth and sprinkle it lightly also.

The Wheel of Life

By Sir Albert Howard

ONE of the contributions of the ancient religions of the East to agriculture is the conception of the Wheel of Life so common in the religious pictures of the Buddhists. This has been adopted as the motto of the New Zealand Compost Club as follows:-



By a strange coincidence I received by the same post in June a copy of a New Zealand publication, on which the wheel was portrayed, and also a letter from Captain Edward Pellew, Erw Wen, Penrhyndeudraeth, Merioneth, North Wales, who used to reside in the South of France, who wrote:-

"To the north of the town of Pau in the Basses Pyrenees there is a tract of country five miles wide by fifteen miles, which I think must have been a lake because the soil is a silt, very fine, no stones, dark grey in color, and quite level, the natural vegetation is gorse and a long grass 18 inches to 2 feet high. No farms on it fifty years ago, but now dotted with very flourishing small farms, and this is the explanation. The

town of Pau is cleaned out every morning in this way—everyone puts their rubbish, dust, vegetable refuse, etc. etc., out in a box in front of their houses. Then farmers who have bought a tract of this silt soil come round and collect the contents of the boxes and take it out to their land. They do this in rotation, each man comes in twice a week; at their farms they pick out the tins and glass, etc., and make a rough compost heap of remainder. It is really striking what crops they get when this is dug in. The mixture of household refuse with manure from their milk cows has turned the silty soil into very rich grain and vegetable land. Small towns in Great Britain might copy this."

Captain Pellew also drew my attention to the following quotation from Victor Hugo's *Les Miserables*, which appears on the title page of *Essays in Rural Hygiene* by the late Dr. George Vivian Poore was published by Longmans, Green, & Co. in 1894:-

"The heaps of filth at the corners, the cartloads of mud scattered at night all over the streets, the horrible refuse bins of the street cleaners, the evil-smelling streams of slush running down the gutters under the pavement, do you know what they are? They are flowering hayfields, green grass, thyme and sage, game and cattle, the contented lowing of bullocks in the evening. They are sweet-scented hay, golden wheat, bread for your table, hot blood in your veins, health, joy and life. Mysterious creation, which is transformation in earth and transfiguration in heaven, thus ordains it.

"Put it all in the melting pot. Abundance will come out of it. The nutrition of plants is the food of man.

"You are the masters. You can squander these riches, and you may take me for the most ridiculous of beings. That will be the masterpiece of your ignorance."

Captain Pellew suggests that the above passage from *Les Miserables* should become the motto of our agricultural schools and colleges. It might also be affixed to the walls of the council chambers of our agricultural research institutes and of the Ministry of Agriculture and the County War Agricultural Executive Committees.

Aphis on Beet

Ministry Announces Arrangements for Control

From THE FARMER'S WEEKLY (London)

ARRANGEMENTS have been made for machines operated by Messrs. Pest Control Ltd. to help farmers to tackle attack on sugar beet by black aphis.

They have been made by the Ministry of Agriculture together with the British Sugar Beet Corporation, the N.F.U. and the Sugar Beet Seed Producers' Association.

The methods of control are (1) machine dusting of fields by nicotine, which, carried out on a large scale has resulted in a kill of about 95 per cent., and (2) gassing with vaporised nicotine by special high clearance tractors, achieving a mortality approaching 100 per cent without appreciable damage to crops.

This service is intended primarily to safeguard crops of sugar beet seed and sugar beet from attack by this pest. Subject to this consideration the machines will be available to deal with infested crops of other seeds, peas, beans, strawberries, and Brussels sprouts, particularly in sugar beet growing areas.

Information as to charges for treatment, procedure, etc. in respect of sugar beet seed, sugar beet and other crops may be obtained from Messrs. Pest Control Ltd., at Harston, Cambridge, or the Sub-Office at the Chequers Hotel, Holbeach, Lincs.

Note by Sir Albert Howard.

In addition to this assault

and battery on the *Aphis*, sugar beet growers might try the effect of the restoration of soil fertility (by means of deep-rooting leys and compost) and the re-establishment of the earthworm population (by the avoidance of sulphate of ammonia) on this pest.

The appearance of *Aphis* on sugar beet suggests that the aeration of the soil is the root of the trouble. This can be put right by re-creating the compound soil particles and the aerating tunnels of the worms. Once all the soil is in order, the *Aphis* will automatically disappear. Its destruction by poison sprays only amounts to superficial tinkering.

Chemistry and Health

From THE FARMER'S WEEKLY (Bloemfontein)

MR. Meredith's attempted answer to me in your issue of August 26 is an interesting illustration of advocating the commercial test as a substitute for scientific investigation. With unconscious irony he stresses the very attitude we are warned against by such eminent men as Lord Northbourne, Sir Albert Howard, Sir Bernerd Greenwell and others whose number is increasing. These disinterested thinkers claim, on good grounds, that immediate commercial gain, as reflected in values of products sold on the open market, obscures the harm wrought by practices that are detrimental to sound farming and injurious to the national health—practices which benefit only these commercial interests bent on fostering them for immediate financial gain.

Dr. Picton, of the Cheshire Medical Panel, illustrates the point with an anecdote about a man planting potatoes with chemical fertilizers. Asked if it is true that such potatoes turn black in the pot and lack flavor, the man agrees, but says he uses fertilizers because people in the open market judge by superficial appearances. "We ourselves," he adds, "of course always plant a couple of rows without any fertilizer for our own home use."

Mr. Meredith admits that he and his colleagues have not evaluated scientifically the pastures grown with chemicals. But Sir Bernard Greenwell, in England, is one of those who have proved conclusively that pastures fertilized with compost raise healthier cattle than any other. Such feeds are more economical, effecting a saving of as much as ten per cent in the quantities needed to get results. And the cattle are possessed of high natural immunity to disease. He and others have had such cattle rub noses with other animals suffering from foot-and-mouth disease and yet remain healthy without injections, medicines or other treatment.

The serious charge against chemicals is that they give a superficial appearance af quality, with a real inferiority in feed value. Parallel with increased use of fertilizers we have had increased need for chemical sprays and medicines, to maintain apparent health. Varieties of plants "run out" with chemical fertilizers, but do not "run out" with compost.

Surely, with such serious charges, we cannot leave the issue to those who are judge, jury, witnesses and accused in their own case? The health of our nation, the well-being of our most essential industry, ought always to be paramount to the vested interests of shareholders in a commercial enterprise.

Robert Lawrence McKibbin
41 Douglas Avenue, Craighall,
Johannesburg.

Organic Preparation For Growing Trees

By Chas. E. Nelson

I drive a stake at the position I intend the tree to set. Then I attach a 5 ft. string to the stake and describe a circle 10 ft. in diameter. I remove all the soil within this circle to a depth of 10 to 12 inches, after which I fill this hole with dried grass, natal hay or other vegetation and stamp it down until the hole is ¾ full.

While filling with grass I spread a sprinkling of lime every 3 inches of depth for fruit trees and no lime is added if acid loving plants like gardenias are to be planted.

Then I rake back as much of the top soil as will fill the hole even with the surrounding soil, all during this operation I let the garden hose run in the filled hole, this causes the soil to be thoroughly mixed with the grass and at the same time drives all the air out and packs the soil. It is better to add a small amount of well rotted manure or chicken manure if available as I find it sets up a bacterial action more rapidly.

You may plant your tree or shrub as soon as you have finished the hole, but it is better to let these holes age several months. Now, will say that if this plan is followed the results will be unbelievable.

The soil where this plan was followed is locally called "sand soak," and will not grow even natural grasses.

About 5 years ago I planted a Mulberry tree about 2 ft. high in this soil; it stood 3 years and made no growth whatever, then I planted it in a prepared hole as described above and in one year it grew 10 ft. and bore a crop of fruit.

Also planted an orange tree the same way, in one year it grew 8 ft. which is unbelievable and I challenge anyone in Florida to show me its equal for a 2 year old tree. It appears to be 4 or 5 years old. Having planted 80 acres of citrus groves I should know what the normal growth should be. Since then I have planted all the trees in my home orchard —oranges, grapefruit, tangerines, tangelo, sapotes, mulberries, persimmons, figs, peaches, pears, loquats and guavas by this method and with the same startling results. This plan has been followed with shrubs and palms with the same results.

It is interesting to note that all fruits on my trees have not been sprayed and yet are clean and free of any scale or pests so common here.

If you have any "doubting Thomases," I'll be glad to show them my trees any time they are in this vicinity.

Storage of Compost in Winter and Summer

By F. H. Billington. N.D.A., N.D.D.

From THE COMPOST CLUB MAGAZINE (New Zealand)

UNDER good management, ordinary compost should gradually improve in quality for about two years, unless decay is unduly speeded up by liberal aeration—possibly at the expense of some loss of humus.

Since there *should be* much less loss in a heap than in the soil, it is sound policy to hold over any surplus *fairly mature*

compost remaining in autumn, until the following spring. Whilst change and decay due to oxidation (slow combustion) never entirely cease, loss during long keeping can be reduced to a minimum by damping down the heap—as one would a fire—by reversing the conditions promoting rapid rotting, together with added protection from weather.

Winter rains are a frequent cause of loss through waterlogging and actual leaching away of plant food. Adequate protection is often overlooked when there is little activity in the garden. The following simple measures should do much to preserve stored compost.

The Uncontained Heap

Cover the sides and ends with corrugated iron or asbestos—cement sheets—otherwise unserviceable pieces of requisite length will serve. If iron is used, temperatures will be kept even by laying about six inches of roughage on the soil covering, i.e., under the iron. A close fit at the ridge is not necessary, what little rain enters there will be useful in maintaining requisite moistness. Stability and fit are improved by placing a bolster-like roll of pliant scrub, raupo, maize stalks, etc., along the top of the heap to support the sheets. The lower ends are better pegged—soil is liable to be washed away or to interfere with free escape of water. The sheets must, of course, be well secured against wind—fairly stout logs about the length of the sheets are simple and satisfactory.

The more the heap conforms to the desirable pyramidal shape, the easier its protection —many alas! resemble no geometrical figure, but approach the shapeless.

Failing sheeting, the heap may be thatched about six to nine inches thick with straw, rushes, flax, raupo, etc. An effective way is to lay odd lengths of wire netting from side to side, over the ridge to keep the thatch from sinking into the soil covering. The thatch is then laid on this and secured by netting laid similarly over it; weighted or pegged on the ground. Lacking netting, the thatch may be secured as on a haystack by stout cord, or twisted hay ropes, and pegs driven *upwards* well into the heap.

Bins

Two iron or asbestos sheets about 5 ft. long will roof a box 4 ft. square and give sufficient water clearance. Fall, temperature regulation and ventilation are ensured if a light covering of roughage is put on the compost and the *weather side* of the box is raised a few inches, by nailing on an extra narrow board. For lengthy storage it may be worthwhile to tack strips of old roofing felt along the air spaces between the boards, especially if these be wide.

Indoor Storage

Some careful gardeners store *matured* compost in sheds or outhouses—an excellent plan if feasible. Furthermore, a box can thus be set free for a new 'charge'. In this case, since the aim is to *retard decomposition*, concrete floors and walls are suitable and convenient. Stored suitably moist in a place free from draughts, a covering of wet sacks will keep the heap right for lengthy periods.

Whichever of these methods is adopted, little is required beyond making sure occasionally that the compost is not getting too dry. Judicious watering or better, for heaps in the open, exposure to just sufficient rain is the obvious remedy.

Summer Storage

The same devices will protect the heap from strong sun equally well if insulation by roughage of any iron is thorough. Boxes are sometimes covered with rough tenting or awning of hessian, old canvas, etc., suspended on a ridge pole to give a fair clearance. The life of these covers is short at best, in a windy place very short, whilst the advantages over the methods mentioned are not obvious.

Less Artificials —Better Cheese

The opinion that the less extensive use of artificial fertilizers was a factor contributing to the higher quality of cheese produced in the Auckland Province last season was expressed by the president, Mr. A. Meharry, when addressing the annual meeting of the Auckland branch of the New Zealand Dairy Factory Managers' Association recently. Although cheesemakers had experienced a poor season compared with the previous one, there had been a decided improvement in the quality. While many reasons had been advanced as the cause of this, most makers agreed that the decreased use of fertilizers owing to war conditions had made manufacturing easier.— *The New Zealand Herald.*

News of the Month

The Last of the Virgin Sod

I

We broke today on the Homestead
The last of the virgin Sod,
And a haunting feeling oppressed me
That we marred a work of God.

II

A fragrance rose from the furrow,
A fragrance both fresh and old
It was fresh with the dew of the morning
Yet aged with time untold.

III

The creak of leather and clevis,
The rip of the coulter blade,
And we wreck what God with the labor
Of a million years has made.

IV

I thought, while laying the last land
Of the tropical sun and rains
Of the jungles, glaciers, and oceans,
Which had helped to make these plains.

V

Of monsters, horrid and fearful,
Which reigned in the land we plow,
And it seems to me so presumptuous
Of man to claim it now.

VI

So when, today, on the homestead,
We finished the Virgin Sod
It is strange I almost regretted
To have marred that work of God.

Yields Falling

Science produces new aids to agriculture—new machines that do the work of a score of men, new crop varieties thus thrive in climates formerly considered too harsh for agriculture, new fertilizers that double and treble yields—yet taken the world over the average output per unit of land is falling.—*The Rape of the Earth* (*Jacks & Whyte*).

Manure Binds the Soil

Although it has long been known that manuring or the green-manuring of a soil checks washing or erosion, it has only recently been discovered that the effect of manuring goes much further than simply holding the top-soil in place.

Tests by soil researchers of the United States Department of Agriculture show at least two other ways in which decay of the manure curbs erosion.

(i) Decay bacteria supply a mucus that acts as a glue or cement to join many very fine soil particles into larger masses —aggregates—that do not wash away so readily.

(ii) A fungus feeding on plant tissue throws out growth called mycelium. This mycelium growth is able to bind together the very fine particles of soil in much the same way that larger roots bind together larger aggregates.

The scientists measured the soil binding work of bacteria and fungi in an experimental way by adding sugar to soils as food for these organisms. Sugar alone did not bind soil; but, when organisms fed on the sugar, they lived and died and left the soil in better physical condition to resist washing.

Organic Matter

People must be advised that organic matter, all of it, is of very complex chemical structure like the vitamins. Giving the roots of plants the inorganic chemical elements is just like throwing into a confused heap, all disassembled, all the parts that go into the making of a house and telling the prospective dweller — "Here is your house—now go and live in it". It has taken civilized men only a few hundred years to develop the dwelling houses we know. It has taken nature millions of years to develop organic matter of any kind.—*H. C. Haas.*

Lord Kames and a Farmer

Lord Kames paid great and successful application of the improvement of agriculture. A number of years ago, a German quack, who called himself Baron von Haak, vaunted of having discovered a power-

ful fertilizing manure, which he advertized for sale, pretending that a very small quantity sufficed to fertilize an acre of land, in a very extraordinary manner. Happening to converse with one of his neighbors on this subject, a plain sagacious farmer, the farmer observed to Lord Kames that he had no faith in the Baron's nostrum, as he conceived the proposed quantity was vastly too small to be of any use. "My good friend," said Lord Kames, "such are the wonderful discoveries in science that I should not be surprised if, at some future time, we might be able to carry the manure of an acre of land to the field in our coat pocket." "Very possibly," replied the farmer, "but in that case I suspect you will be able to bring back the crop in your waistcoat pocket."—*From the Scotsman's Library* (1825)—*sent in by Sir Albert Howard.*

Garden Owners Welcome Toads

Having been told by a garden expert that one horned toad is equal to a gallon of poison bait for killing plant pests, Victory garden owners in Portland, Oregon, welcomed the news that a second horned toad has been discovered in that city. They are hoping more will migrate from their desert habitat.—*Nat'l. Humane Review.*

Storing Potatoes

The United States Department of Agriculture advises that potatoes should be stored under a temperature of between 40 to 50 degrees Fahrenheit. If potatoes are kept in a place that is too warm, they will practically burn themselves to death by using too much oxygen. Then decay usually results. Because of the large amount of starch that a potato contains, action usually starts when the temperature falls below 38 degrees Fahrenheit that turns some of the starch into sugar.

This not only causes the potato to become less attractive to the palate but it turns it a very dull dark brown color the same as potato chips develop sometimes. Where this has occurred, it is best to bring the potatoes to a place with room temperature at least for two weeks before they are going to be used. This will make the sugar turn back to starch and will bring it back somewhat in quality.

The Origin of Peat

When spring displayed her quickening powers
Up sprung aquatic plants and flowers,
So thick, the sun could scarcely trace
His image in the liquid glass.
Rearing its brilliant head between
Broad floating leaves of glossy green
The yellow water lily swum
Upon the surface of the scum.
Like serried groves of hostile spears
The reeds uprais'd admidst the meers
Their pointed heads of dusky brown
By every passing breeze bow'd down.
There rose the waterflag which decks
Its golden leaf with purple specks,
And water plantain to the view
Appearing like the pictur'd yew.
The bulrush overlook'd the rest
With polish'd shaft and knotted crest
And many more which to describe
Would puzzle half the simpling tribe.
Which when drear autumn nipt their bloom
Sunk down into the watery tomb.

William Harrison,
The Fen Poet.

Cited by Miiller and Skertchly.

"Slugs won't eat your young lettuce if the latter are sprayed with a mixture of soot and soft soap," declares a gardening expert. Nor would we!

Reader's Correspondence

Dear Mr. Rodale:

I finally received the April issue setting forth the Petty Process of composting and have one pile going through by that method. I have 3 piles in different stages and I think they have about 2000 cu. ft. compost in them. The first pile I made has been turned twice now and it sure is fine. I use a 12 tine manure fork and after I turn over a pile I can spade up the ground where it was with

the manure fork and find lots of worms in it. I don't have enough refuse so I get the street sweepings from the city which they are glad to let me have. I work into these piles what little garbage I have and it works out fine. In one pile I had a lot of old rags and newspapers and I worked these in and on the first turn I didn't find any. The last load of street sweepings I got had one dead chicken and two pigeons in it and before I got to it my dog was rolling around on the pile as he found it. After I got it in the pile, that was the last of it. Best regards.

Yours respectfully,
J. Robert Shine

When my subscription expires let me know. I don't want to miss a single copy.

What is the best way to apply compost to the soil for a crop of corn?

Answer

If you have sufficient compost, we would suggest that first you apply some of it to the top of the soil and then plow it under. It is theoretically best to apply compost on cloudy days and also to plow it in as soon as possible after applying it to the surface. In some cases, therefore, if you have a large field, it would be best to do it in portions and as you place the compost in a small portion, then follow it up immediately by plowing. After the compost has been plowed under, then put another dressing of compost on the top and disc it in. In this manner you have two layers of compost, some near the top and some further down.

If you do not have sufficient compost to do this, plow first. Then spread compost and disc it in.

Dear Sir:

I have been reading Organic Gardening for some time now and find it very interesting in regard to the use of compost. I have been saving leaves and grass, making a compost heap for at least 10 years, but I always let it stand for two years before using. Is it best to use the first year or has it lost some of its good quality by letting it stand another year?

Through you I mulched my tomatoes and had the best tomatoes and vegetable garden in years.

Respectfully,
John Muller
Fair Haven, N. J.

Answer

Dear Mr. Muller:

Where compost is allowed to stand without turning and without using the layer method as advocated by Sir Albert Howard, it would, no doubt, take two years to complete. This is the common way of making compost. No doubt, some of the value of the material is lost by standing that long.

Considering the speed with which the material can be made by using the Howard Method, we believe that it would show much better results.

Gentlemen:

I want to continue receiving your very interesting magazine, by far the best I have come across. This summer I followed out your instructions when making my compost heap: the results have been all that you claim. I shall never buy any more artificial fertilizer. I have been trying out the compost when making soil mixture for my cacti. They are thriving in it, in spite of all the articles written to the effect that cacti should not get very rich potting soil. When I read your magazine I often think of what an old German lady said to me about plants: "You must feed them with rich compost".

Mrs. W. L. Forrest
Jamaica, N. Y.

Gentlemen:

There are two questions I would like to ask.

First: How could compost be made out of doors in this section of the country where the temperature in the winter time would be below freezing from November 1st until April 1st, probably averaging 10° above zero and at times 25° below?

Second: Would it be practical to use hydrated lime instead of ground limestone?

E. P. Smith
Menominee, Mich.

Answer

Dear Mr. Smith:

It is very difficult, if not impossible, to make compost out of doors in the winter. Some attempts have been made to make compost on a limited scale in heated cellars in the winter time.

Compost heaps can be made out-doors in the winter, but they will not begin to act until spring. There is no harm, therefore, in making the heaps as the materials accumulate provided you keep your supply of earth from freezing. The action of the snow on the top of the heap will be beneficial.

We would say that hydrated lime is better than ground limestone for the heap because

ground limestone is much slower acting.

In a concrete compost pit that I am building, should provision be made for drainage?

Answer

In making a compost pit out of concrete, be sure that the floor of it is of earth. Do not concrete the base. Ordinarily, no drainage would be necessary, but should there be excessive rains, it might cause trouble. It would be wonderful, therefore, if you could tap off from the bottom of the pit and let the liquid excess discharge into another pit. In the second pit, you would, therefore, have compost water. This is a very rich water that has come through the compost and which could be used for watering your vegetable garden. Wonderful results are obtained when such compost water is used.

The second drain pit must be deeper than the main pit.

Dr. Ehrenfried Pfeiffer

One of our readers asks whether earthworms will destroy the fine root hairs. We know that if there is plenty of organic matter in the soil, the earthworm will not attack the roots of plants. The fine root hairs, however, are so easy to get at that it may be possible that earthworms would attack such hairs. Can you help on this subject?

Answer

Dear Mr. Rodale:

Earthworms do not attack live roots as long as there is humus or any organic matter in the soil. If they eat live roots, including hair roots, then something is wrong with the soil itself. The farmer or gardener then should not blame the earthworms but himself.

Very sincerely yours,
Ehrenfried Pfeiffer.

Excerpt From Letter:

It is all right to plant small potatoes, whole, provided they are free from disease and will sprout better and more uniform than those that have been cut. When the potato is cut the minute cells are damaged and this must form a callus before the tuber will sprout. Sometimes this callus doesn't form and the seed piece rots in the ground.

It doesn't make any difference how run down your 63 acres are, as long as there is some soil left, the system you are following will bring it back and you can depend on it.

J. Robert Shine
Riverside, Calif.

Dear Sir:

Received my June issue of Organic Gardening a few days ago, and as Mr. F. E. Callaghan expresses himself in The Reader's Correspondence section I have become so enthusiastic in my desire to raise foods from properly fertilized soil, and to spread this knowledge, that at times I can think of little else.

Upon receiving my first copy of your magazine I immediately started my first compost heap. I now have four.

From the store where he is employed, my husband brings home each day the chicken cuttings, meat cuttings, feathers and sawdust from the floor of the meat market. Not being able to assemble all of my material at one time—it takes one from two to three weeks to complete a heap. I keep it covered with straw and soil but do not water it until completed. Is this method as satisfactory as where the heap is finished in one operation?

Is it all right to trench fresh cuttings, sawdust, etc., around fruit trees?

In the June issue I note in one section you recommend the use of sulphur, and in answer to a subscriber's question you condemn its use. Now I may be wrong about this or may not have understood your explanation of its use. Will you put one right on this?

Thank you for your grand magazine.

Sincerely,
Mrs. H. J. Schouer
Roseville, Calif.

Answer

Dear Mrs. Schouer:

It is best to try to make the heap at one time where sufficient material is available, but where it is not, it has to be done over a period of time and there probably would be a slight loss as far as the manure is concerned.

It is alright to put fresh straw around fruit trees, in fact, this is excellent and acts as a mulch. It would be fine if you could put compost under this mulch. Saw dust itself is somewhat acid and should not be used as such around fruit trees without first decaying it in a compost heap. We would never put any fresh chicken or fish cuttings around a tree. Always compost them first.

We do not recommend the use of sulphur.

Dear Sir:

May I have a little help please? I am struggling with

my compost heaps and find it quite a chore. My question is this: Could I use sheet composting and just how do you manage it? We have a small herd of milk goats and so get quite a lot of manure. We cut the hay for them to avoid too much waste. I must clean out mangers at least twice a week. All this of course is of value for my compost. We have wood ashes also. I thought I could combine what I have in a form of sheet compost? Please advise.

Sincerely,
Doris Juttner
Corvallis, Oregon

Answer

Dear Mrs. Juttner:

The knowledge and experience about sheet composting is quite limited. In principle, you apply your manure on the surface of the land and cover it with the green matter such as straw or spoiled hay. There is the question as to whether the action of a strong sun would dry out some of the manure. First, I would suggest that where there is not sufficient time to turn over the compost heaps, to rather make the heap and let it rot without turning over, but to allow the heap to stand a few months longer than the usual three or four months.

Your wood ashes would be ideal for the compost heap as it is superior to ordinary lime.

Gentlemen:

I would like you to suggest a workable plan for the practical use of our yard and garden waste in the manufacture of vegetable manure. The gardener comes one day a week to mow the lawn, tend flowers, garden, etc. He accumulates much waste that day and it must be taken care of that day. It would make possibly one layer of the size pile you recommend but it would take 4 or 5 weeks to accumulate the large amount you suggest and then all that time would be wasted if there is not some way we could handle it as fast as it is accumulated.

Very truly yours,
H. E. Eigher
Terrace Park, Ohio

Answer

Dear Sir:

Where you do not have much material at one time, I would suggest that you allow your stuff to accumulate for five or six weeks. In this manner your green material will wither, which is preferred. Where you put withered green material in the compost heap, it will decay there much better.

Regarding the manure that you might have and which would accumulate, it would be best to cover it, if possible, until the time it is put into the compost heap.

My dear Mr. Rodale:

I have an easterly exposed Vermont hillside of some four acres which was used as a pasture when I bought it five years ago. It must have been very poor pasture. A few pine trees are coming up here and there; otherwise it is chiefly hardhack, golden rod, and measley poor grass. I have just had all this cut off. Would you be so good as to tell me what the next steps should be to begin to put that land into condition for good pasture, fruit trees, raspberries, grapes, garden—good organic foundation work. I have no livestock, but have a lot of very ancient, mostly horse manure all dried out, which I had hauled from an old barn cellar. I could get a few loads of fresher manure, but not too good as it is heaved outdoors by hand every day and let to stand in a growing pile.

I expect I should try to compost the cuttings. Then, what about the hardhack roots? Could I sow ladino clover, or winter rye, or what, this fall? Should the hillside first be plowed, harrowed, or what—it being rather steep, I wonder if it is feasible to sow seed on top this fall, and plow it all up in the spring?

How about using a dressing of lime there—and also, on land that is lightly sour that I want to use for garden? I am not clear whether the use of lime is good organic practice.

Yours sincerely,
Carol Brown
Putney, Vermont

Answer

Dear Miss Brown:

Regarding your question as to pasture, it all depends on local conditions and I believe this would be a problem for your local county agent who would be glad to come to your farm, make a survey and advise how to start things off to obtain a good pasture. The question that you asked would require a whole chapter to answer.

What we would recommend is that you study the various issues of Organic Gardening and apply the organic idea to your land. We are going to soon have articles about the Clifton Park System of Farm-

ing, which will describe certain seeds which are mixed into the pasture mixture which plants have very deep roots and which break up the ground to a considerable depth. The roots are so numerous that when they decay, your ground is very much enriched with organic matter. Such seeds include the chickory and orchard grass. Your old manure would have to help the structure of your soil but would have little nutritional value for plants.

Any fresh manure that you can get should be placed in compost heaps.

Lime may be used and is considered good organic practice. Planting of green manure crops and plowing them under, would help although if your land is very poor, its ability to digest green manure crop is likewise poor. If your land becomes richer organically its ability to digest green manure crops increases phenomenally.

Gentlemen:

Where I live tobacco stems and tobacco in finely powdered form is available at a very reasonable price. Will you kindly advise whether this tobacco can be used as a fertilzer and the manner in which it can be used for maximum benefit.

Hugh Wallace
Evansville, Ind.

Answer

Dear Mr. Wallace:

In reference to your question about tobacco stems and tobacco in finely powdered form for use as a fertilizer, most of this material is used by the tobacco growers, themselves. The tobacco growers in Lancaster, Pa., I know, purchase all of the tobacco by-products from nearby cigar factories and use it. That is probably satisfactory, but inasmuch as tobacco is very strong, there is a question in my mind whether it should be used where food crops are being produced. One thing is certain. It should never be used raw on the land, but it should be composted and decayed. I have never had experience with it, but I believe that the composting process would neutralize the strong element in the material.

I have been in the tobacco growing country and where the tobacco leaves are hanging in the barn to dry, one can almost be overcome by the strong fumes of the leaves. As you know also a tobacco mixture is used to kill insects on plants so that possibly the application of raw tobacco material to the land would kill off some of the beneficial organisms in the soil. It is too bad that no experimental evidence is available on the effect of tobacco fertilizer on food crops.

Dear Mr. Rodale:

Your Federal Program seems very promising, especially when you begin "Evidence that piles in from every corner of the earth, shows conclusively that man would be much healthier, both physically as well as mentally, if he ate food that was raised by more natural methods". In fact it is so promising that when you write "The ragweed which causes hay fever" one is not only surprised but confused. But when you again write in the August issue "ragweed which is the cause of hay fever" one is more confused because under "notes" you write "a fertile soil is the true basis of health in plants and animals".

My understanding from reading Organic Gardening was that you believed that "We are what we eat". For instance in the April issue you wrote "Real positive health will come when we eat food raised properly and processed properly after it is produced". And in the February issue "A well nourished person, with the full allotment of minerals and vitamins is mighty near immune as far as disease, aliments or other ordinary disorders are concerned".

Also articles by Sir Albert Howard, Charles Gerrish, Sr., Mildred Jensen Loomis, Bernice Warner, Cecil D. Bachelor, and T. H. Sanderson-Wells which have appeared in Organic Gardening seem to show that as Mr. Howard writes, "A fertile soil means healthy crops, healthy livestock and last, but not least, healthy human beings".

If what you and your contributors have written is true then isn't it likewise true that if ragweed causes hay fever it would not cause it in healthy persons? But perhaps if the soil was healthy it wouldn't grow ragweeds. If ragweed caused hay fever would not everyone have hay fever in ragweed season but ragweed does not cause hay fever in all hay fever sufferers. Will you please let me have your opinion of this?

F. L. Suttles
Greensboro, N.C.

Answer

Dear Mr. Suttles:

Replying to your letter, you must admit that it would take a few years to condition your soil and to get the benefit from the food that you eat, grown organically, to such a point

that it would prevent disease. In our federal program we are assuming that the large bulk of the public will not get such food so that even perhaps 20 or 30 years from now, very few of the general public will be able to secure properly grown food. In my editorial then, I was aiming at the general public.

The old-time American Indians never got hay fever nor have there been bald headed Indians. Neither did the Indians use chemical fertilizers.

Please bear in mind also that eating healthy food will not cure all sickness. Some of this is due to the structure of our bodies. For example, it has been shown that many persons catch colds because the passageways in their noses are very small. When they eat an excess of starch or due to certain other things that they do, the membrane in their nose expands and shuts off this passage. There are germs in our nose all the time, but if oxygen gets in, it will keep them in check. When the swelling of the nasal membrane shuts off this passage, then the germs have a field day and a cold results. There is a form of finger surgery by which the doctor merely with the use of his finger enlarges these passageways and persons so treated become practically immune to colds.

It is possible that in the very distant future the families where food grown properly is eaten will give birth to children who have strong bones and fine mechanical construction of their bodies. No doubt then the passageways in their noses may be satisfactory. It has been shown that those people or races whose diet has degenerated are born with jaw bones that are getting weaker and weaker. Medical research workers who are experimenting with tribes where fine diets are in use, find a much better bone construction of the head and face.

In answer to the last portion of your letter, it has also been shown that where the soil is in good organic condition, there are less weeds of all kinds.

Dear Mr. Rodale:

Am making a compost heap in accordance with the instructions you sent me, and in addition have the following available:

Mountain oak leaf mould, wholly or partly decayed.

Mountain oak leaves, (I use this in a closed chicken coop, renewing semi-monthly).

Eucalyptus leaves.

Pepper tree leaves and berries.

Would the inclusion of these in the making of a compost heap be beneficial or detrimental?

Edwin C. Kratz
San Diego, Calif.

Answer

Dear Mr. Kratz:

All the material mentioned in your letter may be used in the compost heap, but should be withered first in a separate heap before being included in your regular compost heap. While withering them it is best to keep them pretty damp.

Dear Sir:

In "Pathfinder" of September 25, I find the following statements:

"Start a compost heap now—for improving the soil next spring—Board in a place some six feet square, and there deposit leaves, lawn clippings, weeds fruit and vegetable trimmings as they are available; mix in layers of soil, add manure if it can be had, and water frequently to keep the whole pile damp. And so build it up all

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Organic Gardening
Emmaus, Pa.

fall and winter. *Some advise the addition of lime or wood ashes but the Department of Agriculture warns that they may cause the loss of nitrogen from the fermenting vegetable matter. It is better to add them directly to the soil."*

Please comment.

O. C. Granlund
Brookfield, Ill.

Answer

Replying to your letter, we have heard it said on many occasions that lime should not be used in the compost heap, but this is based on a chemical supposition. The whole chemical basis of gardening and farming appears to be in need of a drastic overhauling. It has recently been discovered that many chemicals placed in the soil are not in the form that can be absorbed by the plant. Other experiments have shown that plants have evidently taken certain chemical elements from the soil, which tests of the soil showed were not even present. You cannot apply chemistry to the soil without considering the biology of the soil; the bacteria, earthworms and other beneficent organisms.

Sir Albert Howard over a period of more than thirty years has worked out the method of making a compost heap with the use of lime or wood ashes and which has produced remarkable results. Other persons who have followed in his footsteps have similarly reported spectacular conclusions.

Gentlemen:

I find your magazine very interesting and full of valuable ideas some of which I am going to try out at once. I am also bringing herewith a problem to you for a possible solution, namely:

On our farm we are dressing about 200 chickens (broilers) per week and so have a lot of feathers on our hands. The feathers are wet because we dip the chickens in hot water to remove the feathers.

Can you tell me whether or not the feathers would rot away if put into a compost heap and would they make good fertilizers. Naturally they would or could be mixed with poultry, cow and pig manure, as well as soiled bedding straw.

K. A. Rost
Arlington Heights, Ill.

Answer

Dear Mr. Rost:

Replyng to your letter, we have had some experience with feathers and chicken cuttings at Rodale Farms. About a year ago we made some heaps using chicken cuttings and feathers exclusively. There was no manure in these heaps. Nor did we turn these particular heaps. We merely applied earth in between each layer or about five or six layers of chicken cuttings because these heaps were made in the winter time. After staying this way for a year, we find that the cuttings, themselves, have practically decayed, but there is still much evidence of feathers around, so our advice would be if you have feathers separate, to keep them separate in a heap, keeping it fairly wet and it would take several years for it to decay. No doubt if you turn the heaps, it would go much faster. It would be a good thing to put some earth as layers in these heaps, which would consist exclusively of feathers and earth.

Feathers would make a very valuable food for the land because the horn part would be full of calcium.

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